Sports nutritionists' perspectives on enablers and barriers to nutritional adherence in high-performance sport: a qualitative analysis informed by the COM-B model and theoretical domains framework

Meghan RN Bentley [1,2], Nigel Mitchell[2], Louise Sutton[1] and Susan H Backhouse[1*]

[1]Carnegie School of Sport, Leeds Beckett University, UK

[2] English Institute of Sport, Sheffield, UK

*Corresponding Author

Prof Susan Backhouse

Carnegie School of Sport

Fairfax Hall 101, Headingley Campus,

Leeds Beckett University

Leeds, LS6 3QS, United Kingdom

Phone: +44 (0)113 81 24684

Email: s.backhouse@leedsbeckett.ac.uk

Emails

Meghan Bentley: m.bentley@leedsbeckett.ac.uk

Nigel Mitchell: Nigel.Mitchell@eis2win.co.uk

Louise Sutton: l.sutton@leedsbeckett.ac.uk

Abstract

Athlete adherence to nutritional guidance is critical for optimal health and performance, yet little is known about the barriers and enablers to athletes' dietary behaviours within high-performance sport. To advance understanding, we applied a theoretical lens derived from the Capability, Opportunity, Motivation – Behaviour (COM-B) model and the Theoretical Domains Framework (TDF) to explore the qualitative accounts of sports nutritionists. Five focus groups comprising sports nutritionists working in Olympic and Paralympic sport (n = 14), professional sport (n = 6), or both (n = 6) were undertaken. Thematic analysis was conducted and the interpretations of the findings were guided by COM-B and the TDF. To achieve nutritional adherence, the behavioural analysis identified the need to intervene across all three COM-B components and at least five associated TDF domains (e.g., decision-making processes, reinforcement, social influences, behavioural regulation and environmental context and resource). For the first time, the findings illustrate the complex interplay of the training setting with the capabilities, opportunities, and motivation of the practitioners, athletes and coaches. By applying established behavioural science theories to sports nutrition, the foundations for the development of targeted and multifaceted behavioural interventions addressing athlete dietary adherence in high-performance sport have been laid.

Keywords: COM-B model; Theoretical Domains Framework; Nutritional adherence; Behaviour; Sports nutritionists

Introduction

An athlete's daily dietary intake can impact their health and performance. Hence, the importance placed on optimising the nutritional strategies of athletes to maximise training adaptations, reduce risk of injury and illness, and enhance competition performance (Burke & Deakin, 2010; Stellingwerff, Maughan, & Burke, 2011). Specifically, adequate energy intake in combination with an optimal balance of carbohydrate, protein, and fat, is essential for realising these health and performance outcomes (Thomas, Erdman, & Burke, 2016). Yet, athlete adherence to dietary recommendations, even those that are individualised and tailored to meet their needs (Anderson, 2010) – is challenging (Baranauskas et al., 2015; Hornstrom, Friesen, Ellery, & Pike, 2011a). Consequently, an integral part of the sports nutritionist's role is the delivery of dietary interventions to bring about positive change in the dietary behaviours of athletes. However, the weak relationship between knowledge and healthier food choices (Heaney, O'Connor, Michael, Gifford, & Naughton, 2011) demonstrates that delivering educational workshops alone is insufficient to change behaviour (Abood, Black, & Birnbaum, 2004). Instead, multifaceted, systemic and theoretically driven programmes need to be designed and implemented. In line with this need, the Determinants of Nutrition and Eating Behaviour (DONE) framework (Stok et al., 2017) suggests that adult food choice can be divided into four major categories: (1) individual, (2) interpersonal, (3) environmental, and (4) policy factors. Yet, a recent systematic review found most research to date has focused on individual factors (e.g., biological, demographic, psychological) and individual product attributes (price and food labels) (Symmank et al., 2017).

Only a limited number of empirical studies have explored the dietary behaviours of athletes (Heaney, O'Connor, Naughton, & Gifford, 2008; Long, Perry, Unruh, Lewis, & Stanek-Krogstrand, 2011). Nonetheless, the results tend to support the findings of the more extensively

studied non-athletic population. For example, factors influencing male hockey players food selection include health beliefs, time available to eat, taste, quality, and cost (Smart & Bisogni, 2001). Additionally, the findings of a narrative review pointed to athlete food selection being influenced by sport-specific factors such as performance expectations and concerns about body composition (Birkenhead & Slater, 2015). Although synthesised reviews are useful in raising awareness of the complexity of food choice, the application of behavioural science to furthering our understanding of the target behaviour is notably absent from the literature.

Overcoming the theoretical shortcomings of the field is necessary to address issues of nutritional adherence in high-performance sport. At the same time, a shift from individual blame to collective responsibility for nutritional adherence requires the application of a meta-theory that encompasses the wider behavioural system. The Capability, Opportunity, and Motivation – Behaviour model (COM-B) (Michie, Stralen, Maartje, & West, 2011) recognises that athlete behaviour is part of an interacting system because athletes are embedded within social and physical environments. To influence an athlete's behaviour, we need to understand why behaviours are as they are and determine what needs to shift for the desired behaviour to occur (e.g., adherence to nutritional guidance). The COM-B model helps us to answer these questions. According to the model, for an individual to engage in a specific behaviour (B) they must have the psychological and physical capability (C) to engage in the behaviour concerned, the social (e.g., support from others) and physical (e.g., the necessary resources) opportunity (O) to perform the behaviour, and the motivation (M) to undertake the behaviour over other competing behaviours. Motivation covers automatic processes involving emotional reactions, desires and impulses, as well as reflective processes involving self-conscious planning and evaluations/beliefs about what is good and bad (Michie et al., 2011). If more detail is needed to understand the behaviour, COM-B components can be elaborated using the Theoretical

Domains Framework (TDF), which is made up of 14 domains synthesised from 128 constructs taken from 33 theories of behaviour change (Cane, O'Connor, & Michie, 2012). Figure 1 illustrates how domains of the TDF link to each COM-B component.

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Using the COM-B model and the TDF, intervention designers can make a behavioural diagnosis of what needs to happen in order for the desired behaviour to occur. This approach is already evident in the development of a nutritional intervention for a Rugby League player (N. Costello, J. McKenna, L. Sutton, K. Deighton, & B. Jones, 2018), mobile applications to promote healthy eating behaviour (e.g., Robinson et al., 2013) and in the context of medication adherence and hearing aid use (Barker, Atkins, & de Lusignan, 2016; Jackson, Eliasson, Barber, & Weinman, 2014). Such diverse applications offer an illustration of Michie and colleagues' assertion that a comprehensive behavioural model should be flexible enough to analyse any behaviour as the context is incorporated rather than a separate construct (Michie, Atkins, & West, 2014).

In a healthcare setting, studies that examine behaviour typically frame the behavioural diagnosis from the perspectives and experience of the patient (Flannery et al., 2018; Govender, Smith, Taylor, Barratt, & Gardner, 2017). Yet, behaviours do not exist in a vacuum - they occur within complex systems (Atkins & Michie, 2013) as evident in a high-performance setting. Involving potential behaviour change agents in this context - such as sports nutritionists - means that future interventions in the field are co-produced, and co-created programmes are widely believed to be more impactful (Greenhalgh, Jackson, Shaw, & Janamian, 2016). Therefore, this study serves to raise the voice of sports nutritionists to provide a more holistic

perspective of the barriers and enablers of an effective nutrition service in high-performance sport. Performing a behavioural analysis with sports nutritionists, as the primary service deliverer within their sport (Heaney et al., 2008), enabled the identification of intervention options using the COM-B model. In line with our wider behavioural perspective, this study is part of a programme of research that also draws upon the barriers and enablers of nutritional adherence, as perceived and experienced by athletes, in order to understand their capability, opportunity, and motivation for nutritional adherence.

Having made a behavioural diagnosis, the next step is to begin building the intervention and the 19 frameworks identified to guide intervention design have been synthesised and integrated in the Behaviour Change Wheel (BCW) (Michie et al., 2011). This wheel comprises the COM-B model at its centre, with nine intervention functions (e.g., education, skill building, and persuasion) forming the inner ring, and seven policy functions (e.g., service provision, environmental/social planning, and regulation) located on the outer wheel. The BCW allows intervention designers to move beyond behavioural analysis to intervention design (Michie et al., 2014; Michie et al., 2011). Indeed, the implementation of the COM-B model within a Rugby League nutrition case study demonstrates how the BCW can be used to design and implement a nutritional intervention aimed at increasing body mass (Nessan Costello, Jim McKenna, Louise Sutton, Kevin Deighton, & Ben Jones, 2018). Following a behavioural diagnosis using the COM-B model, the intervention was successful at changing dietary behaviour, performance and body composition outcomes. Given intervention constructs should have a clear link to an overarching analysis of the target behaviour (Michie et al., 2011) a comprehensive analysis of athletes dietary behaviour warrants further exploration to build a body of knowledge and recommendations for future sport nutrition interventions. To date, the COM-B model has not yet been applied to further our understanding of nutritional guidance

adherence in high-performance sport, which has the potential to enhance the robustness and efficiency of future sport nutrition interventions.

Guided by the COM-B model and TDF, the aim of this study was to examine the qualitative accounts of sports nutritionists in the context of the barriers and enablers to nutritional guidance adherence in high-performance sport. Specifically, the research explored sports nutritionists' (1) capability, opportunity, and motivation towards nutritional guidance adherence with their athletes and (2) perspectives and experiences on their athletes' capability, opportunity, and motivation to adhere to nutritional guidance. Given we need the capability, opportunity, and motivation to enhance the likelihood of performing a behaviour, the acquired knowledge and understanding will help to facilitate the development of theoretically driven programmes to support sports nutritionists to positively change the dietary behaviours of their athletes.

Methods

Philosophical stance

Situated within an interpretive paradigm this study was informed by our relativist ontology and constructionist epistemology (Sparkes & Smith, 2014), whereby reality is socially influenced and shaped. Our epistemology then guides our acceptance of the findings as the creation of the interaction between the researcher and the researched (Denzin & Lincoln, 2011). As reflexive researcher-practitioners, the dynamics of this intersubjective relationship is informed by our autobiographies, values, and beliefs; which have been shaped and enriched by our prior involvement in sport and our professional experiences of delivering nutritional guidance and/or education to athletes.

Study aim and design

A programme of research is being conducted to develop a theory-based intervention to improve athletes' nutritional adherence. This present study is the first phase of the intervention design process. We used a qualitative descriptive design to conduct semi-structured focus groups with sports nutritionists to identify barriers and enablers to nutritional adherence among athletes in a high-performance setting. Adherence to nutritional guidance is the primary target behaviour in most performance nutrition interventions, and is therefore the subject of inquiry in this qualitative study. By adherence we mean the extent to which an athlete's behaviour matches agreed recommendations from their sports nutritionist or dietician (Ogden, 2012).

A semi-structured focus group guide was developed by MB and SB, and the open-ended questions were based on the COM-B model for understanding behaviour. We developed two to three questions per domain and additional prompts were prepared to probe domains if further clarification was needed. This chosen approach provided the opportunity to explore the multifaceted nature of the meaning the sports nutritionists assign to their practices in a flexible yet consistent manner (Sparkes & Smith, 2014). To illustrate, questions included: Can you describe the opportunities you have to help your athletes stick to their nutritional guidance? Can you tell me how motivated you think athletes are to stick to nutritional guidance? This interviewing method allowed for in-depth exploration around the COM-B categories of capability, opportunity, and motivation, while at the same time ensuring opportunity for practitioners to report on their own thoughts, feelings, and matters important to them (Sparkes & Smith, 2014). Prior to any data collection, the focus group guide was pilot tested with eight sports nutritionists that were not included in the final sample. By conducting a replica of the proposed study, questions that aid, and/or hinder the flow of conversation can be revised and areas of ambiguity clarified (Sparkes & Smith, 2014). Through a process of co-construction

with the pilot study sports nutritionists, a number of the questions were revised in order to ensure appropriate practitioner-used terminology and language.

The study sample comprised of five focus groups of sports nutritionists containing two to nine participants (M = 5). The focus group setting helped practitioners identify and clarify their views. Thus, experiences were shared and opinions voiced that might not have surfaced during individual interviews (Kitzinger, 1995). To generate these rich interactions, the first author (MB) played an active role in facilitating the group discussions (Morgan, 1996).

Participants and recruitment

A purposive sampling approach was employed to identify and select sports nutritionists currently providing nutritional guidance to athletes in either: (1) Olympic and Paralympic sport (n = 14), (2) professional sports (n = 6), or (3) both (n = 6). Participants were eligible on the basis that they were (1) full or part-time employed as a sports nutritionist in the United Kingdom (UK), either at a professional club or institute level and (2) had supported athletes at the highest level in Olympic, Paralympic and professional sport. Participants were recruited through emails and those purposively sampled were asked to refer others consulting in the high-performance domain. Ethical approval was granted from the University Research Ethics Committee in advance of the research being undertaken.

Sample characteristics

Twenty-six sports nutritionists (M = 13 and F = 13) were recruited to participate in this qualitative study. All sports nutritionists involved were responsible for delivering nutritional services at a National Governing Body or professional club level. Participants ranged in age (26 - 52 years, M = 34, SD = 6.97) and experience (<1 year n = 1, 1 - 3 years n = 9, 4 - 6 years

n = 5, 7 - 9 years n = 4 and ≥10 years n = 7). Of the 26 interviewed, 24 were registrants of the Sport and Exercise Nutrition register (SENr) and they represented various sports including cycling, boxing, football, rugby, gymnastics, and hockey.

Procedure and setting

All focus groups were facilitated by one moderator (MB) and were conducted at UK universities, performance centres, and a conference venue. Consent forms were administrated and signed before the focus group began. Brinkmann and Kvale (2015) principles for conducting a focus group were followed and the conversations were guided by an interview template. Focus groups ranged in length from 1 hour to 2 hours 20 minutes (M = 1 hour 33 minutes) and took place between December 2016 and May 2017. Recognising that a group setting may silence individuals with unique personal challenges (McLafferty, 2004), two semi-structured interviews (M = 1 hour 14 minutes) were conducted to allow for in-depth exploration of individual responses to the questions posed.

Data analysis

Following participants' permission, focus groups were audio recorded and transcribed verbatim using NVivo 11. The raw data was then coded using a six stage thematic analysis as outlined by Braun and Clarke (2006). The stages include: (1) immersion; (2) generating initial codes; (3) searching for and identifying themes; (4) reviewing themes; (5) defining and naming themes; and (6) writing the report. Although this staged approach implies a linear thematic analysis process, the analysis undertaken was complex, and 'recursive' (Braun, Clarke, & Weate, 2016, p. 196). During the immersion stage, MB became familiar with the data by listening to and transcribing the audio recordings, checking the transcriptions against the audio recording, reading, listening again and re-reading the final transcripts. MB also kept a log of

ideas sparked by the familiarisation process relative to the research aims (stage 1). Generating initial codes (stage 2) involved MB reading the transcripts and categorising similar statements into the three COM-B categories and further into the 14 TDF domains (deductive analysis). An inductive coding approach was also used to generate subcategories of participants' specific beliefs within the initial coding scheme of the 14 TDF domains. The coded data were further inductively examined to generate themes that represent the barriers and enablers perceived by the sports nutritionists to influence athletes' nutritional adherence. At this stage the findings were discussed in-depth, and on multiple occasions, with SB. The themes were created through the interaction between our assumptions, knowledge, skills, and experiences, and the data (Braun et al., 2016). Stages 5 and 6 elicited a 'thematic map' and the analytic narrative presented in this manuscript being written. Throughout, pseudonyms have been used and the name of training venues removed to protect participant anonymity.

Criteria for judging the quality of the research

Judgments of quality in quantitative research revolve around issues of objectivity, reliability, and generalisability. However, qualitative researchers are required to independently source heuristic devices to make informed choices around pertinent issues of trustworthiness (Sparkes and Smith, 2014). From a relativist, rather than a criteriologist position (Sparkes & Smith, 2009), the research team sought to maintain trustworthiness of the data through characterising traits of the research process. For this, a subset of criteria deemed appropriate to guide the thematic analysis was drawn upon (Tracy, 2010). For example, the worthiness of the topic was illustrated in the rationale for the study, highlighting adherence to nutritional guidance as a relevant, timely, and significant issue. Rich rigour was ensured by drawing upon a sample appropriate for the purpose of the study and generating data that could provide meaningful insights. It is important to note that themes do not 'emerge' from the data (Braun et al., 2016),

instead researchers actively create the themes, and this interpretative process is influenced by their personal experiences, thoughts, and feelings (Braun et al., 2016). In line with contemporary views of enhancing the quality of qualitative research (e.g., Smith & McGannon, 2017) 'critical friends' were utilised. Throughout the study, SB repeatedly prompted MB to be reflexive and regularly challenged the interpretations for the data. An early draft of this paper was also shared with NM and LS who confirmed that the interpretations were coherent and plausible based on their practitioner experience. Lastly, MB presented this work at a professional development day for sports nutritionists and this provided an opportunity for MB to construct, deliver, and defend a coherent narrative and engage in 'critical dialogue' with the audience (i.e., people listened, asked questions, and offered feedback). At all times the researchers' paid close attention to how they were impacting the interpretations of the sports nutritionists' accounts. In recognition of the debate surrounding the use of member checking within interpretivist research, this research adopted a relational reflective ethical position (Smith & McGannon, 2017), whereby mutual respect and connectedness between the researcher and the sports nutritionists prevails. Through a process of member reflections, the sports nutritionists were able to connect with the themes and recognise themselves and their colleagues in the data (Sparkes & Smith, 2014).

Results

Sports nutritionists identified several barriers and enablers to athletes' nutritional adherence in a high-performance setting. Below we describe how the data aligns with the COM-B model and TDF (Table 1). The application of the COM-B framework and elaborating TDF serves to identify components within the behavioural system that can be targeted through intervention in order to achieve adherence to nutritional guidance.

- Insert Table 1 here -

Capability

Sports nutritionists perceived that an athlete's psychological capabilities influenced their nutritional adherence. This is defined within the COM-B model as the capacity to engage in the necessary thought processes, such as comprehension and reasoning.

Devolved responsibility

Sports nutritionists perceived that athletes lack the memory, attention, decision-making, and organisational skills required for the food planning and preparation necessary for nutritional adherence. This was something Vicky illuminated when sharing her experience of supporting athletes:

> I think their organisation skills as well, you know just things like when do they do their shopping, and sometimes you suggest something as simple as have you tried online shopping? And half of them haven't.

The high-performance system was described as an "athlete-centred, coach-led" (Nick) environment, whereby support staff disseminated their expertise into the development of the athlete under the governance of the coach. Kate identified that athletes who have grown up through the sport system "are more used to getting everything done for them, so actually getting them to do a bit more for themselves can be a bit more of a challenge …" This was also a concern within the professional sports as the practitioners echoed that athletes "get everything done for them" (Grant). Jacob further illustrates this point when he says:

> I think professional sports provide too much for their athletes, and we end up babysitting them … and that's the problem, in life and many life skills and

> not just nutrition, they can't even … they can't even phone up an insurance company to sort out insurance for their car, everything is done for them.

Sports nutritionists reflected that the athlete would bring this dependency mindset to the performance nutrition service and insist they are told what to do regarding their dietary behaviour rather than working through the decision-making process to develop their food planning and preparation skills. Kate shares, "they'd sit with me [and] it was like 'so tell me what to eat', it's kind of like, that's not what you want them to do". The findings suggest that athletes' inability to regulate and take personal responsibility for their own dietary behaviour is a barrier to nutritional adherence.

To address deficiencies in food planning and preparation, sports nutritionists sought solutions to help make adherence easy for their athletes. This sometimes involved setting up a food delivery service; removing the need for food planning and preparation. However, Jacob acknowledges that this strategy simply treats the symptoms but not the cause of the behaviour:

> I've got very high profile [athletes], who are very knowledgeable, they know exactly what they need to do, but they just can't be bothered making it … so then you get it delivered, but then you're kind of not treating the cause there are you? You're just giving someone a tablet.

This approach to behavioural regulation appears to be guided by the dominant performance outcome goal of the nutrition service rather than the development of longer-term dietary behaviour skills and competencies. This was something Neil articulated when discussing his view of his role:

> …. are we looking at real long term behaviour change, or are we looking at changes that we want to support the performance we are expecting, so in

> effect … in sport, if we've got a competition say two weeks away, are we really interested in what they're doing in ten, twenty, thirty years or are we really just interested in that performance on that day and I think particularly in professional sports, it's about performance, when we need them to perform.

The experiences of the sports nutritionists signal that performance outcomes are prioritised. Consequently, under these environmental conditions it is not surprising that some athletes may be reluctant to take responsibility for their dietary behaviour and invest in developing the ability, competence, and procedural knowledge for food planning and preparation.

Motivation

Several barriers and enablers mapped onto sports nutritionist perceptions of athlete motivations, which are defined as the brain processes which direct our decisions and behaviours. The COM-B model differentiates between automatic motivation (i.e., emotions and impulses) and reflective motivation (i.e., evaluations and plans).

Performance accountability

According to the sports nutritionists involved in this study, the performance culture of sport reinforces and stimulates a food for performance rather than a food for health response. Reinforcement can be defined as "increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus" (Cane et al., 2012). Grant illustrates this point when he says:

> I think it ultimately, as Jacob says, comes back to tagging it to a performance outcome … if you can't see a tangible performance outcome, then … it's hard

> to get behaviour change. And I don't think health's a good enough outcome for most people.

Focus group discussions between the sports nutritionists revealed how an athlete's performance accountability can act as either an enabler or barrier to an athlete's engagement to the nutritional service. Performance accountability was typically observed in individual sports, such as cycling and boxing. A sports nutritionist working in cycling exemplified this through their experiences, "they all recognise that it [nutrition] can be the difference between winning and losing, and they all want to push it, and push it and push it" (identity removed). One sports nutritionist with experience in boxing said, "if I'm working with athletes and we're trying to get a specific weight, for a specific date for a competition, then adherence tends to be really really good with that …" (identity removed). In comparison, sports nutritionists working in team or skill-based sports discussed difficultly in achieving nutritional adherence as the athletes displayed reduced belief in the performance benefit of nutrition, "sports like football...it's more difficult, because nutrition doesn't dictate performance, it's a skill-based sport" (identity removed).

Sports nutritionists shared that in spite of increased motivation in athletes with greater performance accountability, athletes' motivation would fluctuate in accordance to their competition demands. Here motivation would heighten during periods of competition yet decrease during the out-of-competition period. For instance, Dominic shared "If someone's got a [competition] in twelve weeks' time, they're very focused and they will follow something to the letter, once that [competition] is out the way it's all hell for leather, you know, everything's on the table, literally". In advancing these discussions, the sports nutritionists discussed how they would use performance inhibiting factors (e.g., illness, gastro and injury) to consciously influence the athlete's beliefs about consequences in order to enhance athletes' reflexive

motivation to adhere to nutritional recommendations. Illustrating this, Maisie shared the following:

> I think it's trying to find that hook that links to them. Do they get a lot of illnesses, infections? Do they have any gastro issues? Any bone issues? Or any body comp issues? And then you, once you've found what's important to them, you can then try and sell how nutrition will try to influence that.

This suggests sports nutritionists may play a part in reinforcing performance – rather than health - as a conscious motivational driver for nutritional adherence, which perpetuates the performance narrative of high–performance sport.

Opportunity

Barriers and enablers within the social and physical high-performance sport environment shaped the opportunities for sports nutritionists' provision of the nutrition service. Social opportunity refers to the social factors that influence the way that we think about things (i.e., cultural norms, social cues). Physical opportunity is afforded by the environment (i.e., location, resources).

Role conflict

Through the focus group discussions, it was revealed that prevalent social influences (defined as "interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours" (Cane et al., 2012) impacted upon the sports nutritionist's ability to achieve nutritional adherence in their athletes. The social influencers discussed during the focus groups were the strength and conditioning coach (SCC), the coach, and the chef. Sports nutritionists

described how the SCCs, in particular, could make it difficult for them to ensure their athletes follow their nutritional guidance and that they may undermine the sports nutritionist's approach and bring about role conflict. Emily shared, "that is half of my battle, trying to myth bust what their [SCC] telling them to do … and it's completely the opposite to what I want them to do…" Extending this influence further, Jacob says that nutrition can be used by SCCs to build relationships with athletes who are "looking for that next magic bullet". Jacob expressed frustration with SCCs perceived expertise in nutrition which causes them to work outside of their professional limits:

> A lot of staff gravitate towards nutrition as something that they can influence [athletes] with and build the relationship, when really they should leave it to the person who's employed to deal with that in the first place. Because a nutritionist would never tell the S and C coach … the sets and reps they should be lifting, but the S and C coach will often tell a player what type of protein shake they should be having.

The coach was also identified as significant barrier for athletes adhering to nutritional guidance. Specifically, coaches were referenced as dominant figures who endorse strong cultural beliefs that dispute evidence-based practice and contradict the messages of the sports nutritionist. Martin expressed his battle with managing coach bias based on their previous experiences, "They [the coach] are very quick to instil their previous experiences to their current athletes, because 'oh this is how I did it and it worked for me'…" Focus group discussions highlighted coaches' misconceptions regarding food and body weight. For example, Maisie was stopped by a coach who informed her that "this coach has just said, one of the things they [athletes] should avoid is food." Prior to Maisie working as a sports nutritionist in her sport "food was taken away from them [athletes] by their coaches, there was a perception that you shouldn't eat and that eating was bad". Other harmful behaviours were also shared by the sports nutritionists.

For example, Luke reflected on his experience of a manager acting inappropriately, "The manager at times would go around pinching players body fat, like before a game, saying 'oh you're too big' and it's almost completely destroying their confidence, and relationship with food." The experiences shared vividly illuminate some of the social influences that pervade the sporting environment and serve to highlight the potential power of the coaches and managers in thwarting the social opportunity and motivation of the athlete to follow healthy dietary practices.

The chef was another social influencer identified as an important barrier to or enabler of the dietary behaviours of athletes. Working collaboratively with the chef seems crucial as Vicky alludes, "I work a lot through the chef, because you know he's producing the food, the sort of food that you're advising they consume". However, some sports nutritionists experienced chefs who would contradict their nutritional recommendations, Ethan shared, "one of the chefs was literally like, 'you want chocolate cake tomorrow boys, I'll make one tonight', and he'll just want to keep them happy, no matter what." Maisie proposes that this barrier could be overcome by increasing the chef's nutritional knowledge (psychological capability) and clarifying his role (professional identity – motivation). However, Maisie acknowledged that she lacks sufficient opportunity to do this.

To purposively address the prevailing social influences that impede athletes' dietary behaviours many sports nutritionists discussed the importance of working collaboratively with the multidisciplinary team. Grant shares his strategy, "often … you need to start with the staff before you can get to the athletes, because otherwise…mixed messages are coming across. So, I just need to make sure everybody's … at least on board." This approach focuses on targeting key stakeholders' capability and motivation when supporting athletes' food choices. These encompassed SCCs, physiotherapists, and sports therapist, as they can influence athletes'

dietary behaviour during critical moments such as; training, recovery, and rehabilitation from injury. However, they need to understand their role from the outset to avoid any conflict, or miscommunication.

Environmental incongruence

Within this theme, focus group discussions related to food availability within the training environment and sports nutritionists working capacity including allocated time and resource. The TDF defines environmental context and resources as "any circumstances of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour" (Cane et al., 2012). Across all focus groups, the sports nutritionists agreed that being able to guide the food provision within the sporting environment was a facilitator to athlete adherence to nutritional guidance. Emily shared, "it's so much easier if you're in an environment like [Vicky] where you've got a chef, because you just don't put the crap option on". However, some sports nutritionists were unable to influence the food service within the training environment. Maisie brings this barrier to life as this meant her nutritional messages were not being reinforced but contradicted:

> I'll sit there and talk about what they should and shouldn't eat, why and all this sort of thing and then, we'd finish the session and inevitably we would go straight into lunch … and it would be chips and crisps and I was just like …'are you kidding me', how have I just spent that much time talking to them and then not reinforced it with this, and this was constant, and I had no control, we were in a sports centre it's a Paralympic sport they have very little money anyway.

Maisie expresses further frustration when highlighting the struggles her athletes face in order to adhere to their recommended dietary intake at their national training venue:

> Then they come here and the food is terrible and that's the constant feedback to me was, you're telling me to eat this, and I can't even eat that when I come to [national training centre] of all places, like I'm at the GB squad and I can't eat the foods you're telling me to eat.

The physical opportunity to influence the food served to the athletes was sport specific and appeared dependent on the financial resources and structural influence on the catering team within the centralised training location. For example, several sports nutritionists shared their experiences of negotiating environments that are shaped by local councils and/or event managers. In such contexts, multi-stakeholder use, profit and perceived customer satisfaction appear to drive food provision, rather than athletes' dietary requirements.

Morgan brought congruence to his sporting environment by providing athletes with meals through a specialist food delivery service. Morgan's sport environment is now "just a totally controlled menu … everything [from], breakfast, lunch dinner, snacks". Although Morgan is one of the sports nutritionists who has successfully navigated environmental incongruence, it must be acknowledged that this approach is costly. Therefore, sports who are not well resourced are at an immediate disadvantage when addressing this environmental barrier. Conversely, some sports nutritionist articulated an alternative and paradoxical view, in that an incongruent environment might be to the advantage of the athlete as it necessitates athletes develop their capability for nutritional adherence. Jacob shared the following:

> I'm sure you've seen the quality of their canteen at the [training venue] … it's terrible, I watch the [athletes] there and they bring in their own lunches, which means they've had to cook that, so they need to be a lot more skilled in, basic food preparation and cooking and shopping than what professional football and rugby players do.

Stretched service

Focus group discussions repeatedly underscored the limited time and resource sports nutritionists have for service delivery. Full-time positions are rare and typically "you're only there … depending on your role, half a day a week, one day a week, sometimes twice a week" (Martin). The sports nutritionist role was described as encompassing a number of competing priorities, as illustrated by Martin:

> Your work isn't just with the athletes, your work is with the chef … your work is with the menus, your work is with other hotels, your work is with supplement strategies, your work is with injured players, your work is with staff education.

Additionally, when working at a training venue contact time with the athlete can be limited. Grant stressed:

> I might have to see twenty [athletes] in a day, to get all, because the gaffer wants all the body comps done … but there's like a one-hour time slot in that day where we can see them, between training, between feeds, so now you're like … wow I've got like, a couple of minutes per [athlete] … to get body comps done, and … to change [laughter] behaviour, and to build a rapport … so, it's a combination of us being spread too thin.

Many sports nutritionists agreed that managing employer's expectations is paramount to addressing time and resource constraints. Ethan reflected on his personal development within this area:

> For me it's probably changed, as time has gone on into my career, at first it was just … I just worked every night a late night, you know, they'd only be paying for a day a fortnight or something like that, but you were doing so

> much more, and then you become wiser and say well actually, if you want all those things we're just going to have to renegotiate the contract, because you're asking me for too much

It was professed that an inexperienced sports nutritionist would typically "over deliver because you want to be seen as doing a good job" (Maisie), and with experience comes the art of managing "what is feasible, [and] what is realistic" (Neil).

Discussion

Diet is a pivotal factor in the optimisation of athlete health, well-being and performance. Yet, dietary adherence can determine whether or not these benefits are realised. Our understanding of this behaviour in athletes is limited and therefore in this study we used the COM-B model and TDF to identify barriers and enablers to athlete nutritional adherence from the sports nutritionist perspective. Our findings illustrate barriers and enablers at the intrapersonal, interpersonal, and nutrition service level to highlight how sports nutritionists' perceptions and experience of athlete capability and motivation interact with their physical and social opportunity to influence the dietary behaviours of athletes. It is through this interaction that five themes highlight the barriers and enablers of providing dietary guidance in a high-performance sport: (a) devolved responsibility, (b) performance accountability, (c) role conflict, (d) environmental incongruence, and (e) stretched service.

It is often perceived that plentiful resources are essential for optimal performance outcomes. However, sports nutritionists offered a counter narrative by suggesting that from their perspectives some athlete-centred models provide an abundance of resources that can prove detrimental to athletes' attention, decision making, behavioural regulation, and subsequent adherence to sound nutrition principles. It has been proposed that performance pathways

designed to be as supportive as possible present minimal or no developmental challenges (Collins & MacNamara, 2012). In this regard, athletes are not afforded sufficient opportunity to make their own decisions and this not only restricts their psychological development, it also thwarts behavioural regulation and blunts feelings of autonomy. Instead of preparing athletes for the road, we are preparing the road for our athletes, and this can undermine their sense of personal responsibility and beliefs about their capability to make decisions (Deci & Ryan, 2008). Sports nutritionists in the current study were concerned about the impact that devolved responsibility had on the food planning and preparation skills of their athletes, in particular. These findings point to a need to develop athletes' capability for food planning and preparation by developing programmes of support that target: (1) knowledge, (2) memory, attention and decision processes, (3) behavioural regulation, and (4) skills (Cane et al., 2012). For example, one way to address behavioural regulation is through self-monitoring (Cane, Richardson, Johnston, Ladha, & Michie, 2015) so athletes can be advised to record daily, in a diary, whether they have a recovery snack post-training (as advised).

The findings indicate that sports nutritionists' perceive athletes' motivation toward adhering to nutritional guidelines is largely driven by the external pressure of performance goals; corroborating and extending prior research highlighting that athletes' motivation to adhere to nutritional recommendations alters in response to the changing performance demands of the season (Smart & Bisogni, 2001). In sports where nutrition had obvious performance effects (e.g., cycling and boxing), extrinsic forms of behavioural regulation were reported by sports nutritionists. Specifically, they spoke of their experiences of working with athletes whose motivation to adhere to nutritional guidance has been partially, but not fully, internalised as their own (introjected regulation, Ryan & Deci, 2006). In the long-term, extrinsic forms of behavioural regulation can potentially compromise performance and well-being effects

(Thøgersen-Ntoumani & Ntoumanis, 2006). Therefore, sports nutritionists are encouraged to foster need-supportive climates whereby intrinsic forms of motivation are used to create habit formation for long-term athlete health and wellbeing (Ntoumanis, Quested, Reeve, & Cheon, 2017). Drawing upon the TDF, this can be achieved by promoting nutritional adherence as a coherent set of behaviours underpinning the role and identity of a high-performance athlete. This identity development can be encouraged and reinforced by a collaborative multidisciplinary team approach (i.e., reinforcement) (Cane et al., 2012) which serves to nurture athletes' automatic and reflexive motivation to sustain recommended dietary practices throughout the competition season, and over the long-term.

Sports nutritionists highlighted a role conflict as coaches can instil misconceptions about food and body weight in their athletes. As such, coaches were seen as barriers to achieving nutritional adherence. Previous research has emphasised that coaches are a key source of information and influence for athletes regarding nutritional behaviours (Abbey, Wright, & Kirkpatrick, 2017). Yet, according to previous literature, most coaches do not have specific or formal training in nutrition, and their knowledge (and thus psychological capability) may be insufficient to accurately guide their athletes (Couture et al., 2015). Our findings extend this understanding by revealing that coaches' behaviours may be unintentionally undermining applied nutrition services. Drawing upon the eating disordered evidence-base, a coach's inappropriate behaviour can precipitate or exacerbate disordered eating attitudes and behaviours in susceptible athletes (Sundgot-Borgen & Torstveit, 2010). This concern is further heightened as research has shown that coaches are unable to identify eating disorders in their athletes (Nowicka, Eli, Ng, Apitzsch, & Sundgot-Borgen, 2013). Consequently, they may not recognise their own behaviour as further exacerbating eating problems that may arise. Future

research should explore coaches' attitudes and practices concerning eating disorders and weight-control behaviours, as this remains an understudied area.

The provision of incomplete and misguided advice to athletes was also discussed in relation to SCCs. SCCs have a greater physical presence within the training environment, and are afforded greater opportunity to influence an athlete's dietary behaviour. In line with previous literature on sports coaches, SCCs also provide nutritional information to athletes who are unable to access the advice of a trained nutritionist (Hornstrom, Friesen, Ellery, & Pike, 2011b). Through this qualitative inquiry, we have highlighted that unqualified coaches within a high-performance environment are providing nutritional guidance to their athletes. This leads to contradicting messages being communicated, possibly compromising service effectiveness and undermining the influence of the sports nutritionist. These findings indicate the necessity of a comprehensive nutrition intervention targeting not only athletes, but also coaching staff, and other athlete support personnel. Taking a systemic approach to support staff professional development ensures consistent and cohesive communication amongst the multidisciplinary team; giving athletes better opportunities to access evidence-informed nutritional support. To influence multiple social influencers within a high-performance system sports nutritionists may benefit from developing their persuasion skills and self-confidence to confront poor practice (Cane et al., 2012). To achieve this, targeted training packages (including scenario-based learning) (Michie et al., 2011) should be designed and implemented to better prepare and equip the sports nutritionist to navigate the complexity and nuance of professional practice. As a result of this training, sports nutritionists should be empowered to confront undermining social influencers in the high-performance environment (e.g., S&C Coaches, Chefs).

Previous research suggests eating behaviours are influenced by the environment which can result in automatic eating decisions, and therefore people can be unaware that the environment is facilitating poor food choice (Ogden et al., 2013). This environmental determinant of food choice has been acknowledged by the International Olympic Committee (IOC) who have placed an increased emphasis on athlete food provision at major competitive events, such as the Olympic Games (Pelly, Meyer, Pearce, Burkhart, & Burke, 2014). While the current findings support existing evidence on environmental influences on food choice, they also add new insight. Specifically, sports nutritionists clearly conveyed the profound impact an incongruent environment (physical opportunity) has on the capability of an athlete (including the development of food planning and preparation skills) to adhere to their nutrition guidance. An enabling environment would model the values of good food choices while providing opportunities for athletes to prepare their own food to meet their nutritional requirements. In this regard, sports nutritionists should be in a position where they are able to modify their environment to suit the needs of the athletes rather than be controlled by the environment in which they operate. In the context of high-performance sport, environmental restructuring should be supported by the sports nutritionists as they can help ensure the catering provision and menus are suited to the requirements of their athletic diners from the outset. Finally, although the current findings highlight the importance of the training environment, literature from the study of obesity underscores the importance of the 'toxic food environment' as a trigger for food consumption (Berthoud, 2012; Wilson, 2010). Therefore, considerations of wider environmental barriers and enablers should also be deliberated by sports nutritionists and considered in future research in this field.

Sports nutritionists expressed concerns that limited resources in the sporting system for the nutrition service made it difficult to sufficiently support their athletes and meet the high service

demands of sports. Despite evidence attesting to the value of regular access to a sports nutritionist (Tsoufi, Maraki, Dimitrakopoulos, Famisis, & Grammatikopoulou, 2017), participants described their frustrations with the limited opportunity afforded to them to build the fundamental professional relationships with their athletes because of the limited time available to work with their athletes (Katz & Hemmings, 2009). In addition to raising awareness of resource as a barrier to nutritional adherence within the system, our findings stress the importance of the nutrition service leadership team establishing realistic expectations of practitioner delivery within the service level agreement and communicating these clearly with the sports and the practitioners. These expectations should be determined by the contracted hours of the practitioner relative to the number of athletes they are expected to support. A collaborative engagement process between the sport and the service delivery team should establish and reinforce realistic expectations of the service, which in turn will help to reduce the risk of practitioners feeling compelled to over-deliver in order to be seen as doing a good job. These findings also emphasise the importance of targeted social support (Cane et al., 2015) for neophyte sports nutritionists who do not have the experience to draw upon when deciding what is feasible and realistic early on in their careers. Meanwhile, the routine presence of SCCs and coaches – combined with a stretched sport nutrition service – can elevate the status of other professionals and provide the opportunity for unqualified nutrition guidance. Interventions in this field should embrace the complexity of nutritional adherence by adopting a systems approach that moves beyond individual agency and capability by enhancing the social and physical opportunity for athletes to adhere to nutritional guidance.

Limitations

As with all research, findings need to be interpreted with considerations of the innate research limitations. This study was purposefully aimed at sports nutritionists' perspectives and

experiences of nutritional adherence in athletes, as they are the primary service deliverers within their sport (Heaney et al., 2008). This research does not wish to imply the experiences presented are representative of athletes' perspectives and consequently caution must be taken in the interpretations offered in this regard. The use of a small purposive sample, with the majority of participants being drawn from UK institutes and professional sports whom support athletes at the highest level, also means the identified views on the barriers and enablers of the management of athletes' dietary behaviours may be less representative of sports nutritionists working outside the UK and/or at an amateur level. In terms of our analysis, a deductive approach can potentially restrict findings to the COM-B components and TDF domains; leading to research becoming stagnant in the paradigm created by the lead researchers at the time (Ogden, 2016). However, by taking an abductive approach we were able to identify five overarching themes of barriers and enablers of athletes' dietary behaviours. The use of focus groups also involves limitations. Within this setting there is potential for some participants to feel intimidated by dominant and more experienced group members, which may impede their ability to share their opinions and experiences, reducing generalisability of the findings (Robson & McCartan, 2016). Further research applying the TDF and COM-B model is now required with athletes to explore their experiences, thoughts, and behaviours surrounding the barriers and enablers of nutritional guidance adherence. Collectively, this evidence base will help inform the development of a theoretically driven behavioural assessment framework to guide sports nutritionists in the design of multifaceted behavioural interventions.

Conclusion

For the first time, this research provides an important overview of the behavioural factors enabling or inhibiting nutritional adherence in high performance sport and has identified targets of intervention across a range of inter-dependent factors related to athletes' and sports

nutritionists' capability, opportunity, and motivation. Application of the COM-B and TDF provided a theoretical starting point for understanding nutritional behaviour within specific high-performance sporting contexts, allowing us to begin the process of making a behavioural diagnosis of what needs to change to alter the behaviour. We identified five barriers and enablers to nutritional adherence, based on the perspectives of sports nutritionists. Specifically, (a) devolved responsibility, (b) performance accountability, (c) role conflict, (d) environmental incongruence, and (e) stretched service. The findings suggest a resource constrained nutrition service limits athlete exposure to evidence-informed practitioners with the capability to change athletes' nutritional thoughts, feelings and behaviours. At the same time, the food services made available to athletes both enable and inhibit their food planning and preparation skills and they are typically driven by external performance pressures, rather than the intrinsic value of developing lifelong nutritional habits for health and well-being. These performance pressures are also evident and reinforced by the beliefs and behaviours of the social influencers in the system. Developing nutrition service level interventions that target these salient barriers to nutritional adherence will have greater potential to change behaviour, and optimise athletes' overall health, well-being and performance.

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Table 1: Barriers and enablers to nutritional guidance adherence in high-performance sport

COM-B	TDF Domain	Themes
Capability[a]	Memory, Attention, Decision-Making Processes	(a) Devolved responsibility
	Behavioural Regulation	
Motivation[a]	Reinforcement	(b) Performance accountability
Opportunity	Social Influence	(c) Role conflict
	Environmental Context and Resource	(d) Environmental incongruence
		(e) Stretched service

Notes: [a], according to the perspective of the sports nutritionists